GEANT4 9.5 highlights
## *kernel modules*

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Outline

- Major features to be introduced in release 9.5
  - Geometry
  - Kernel & Interfaces
  - Visualization

➢ *Notes release 9.5-beta (June 30th):*
  - **http://geant4.cern.ch/support/Beta4.9.5-1.txt**

➢ *All planned features for 2011:*
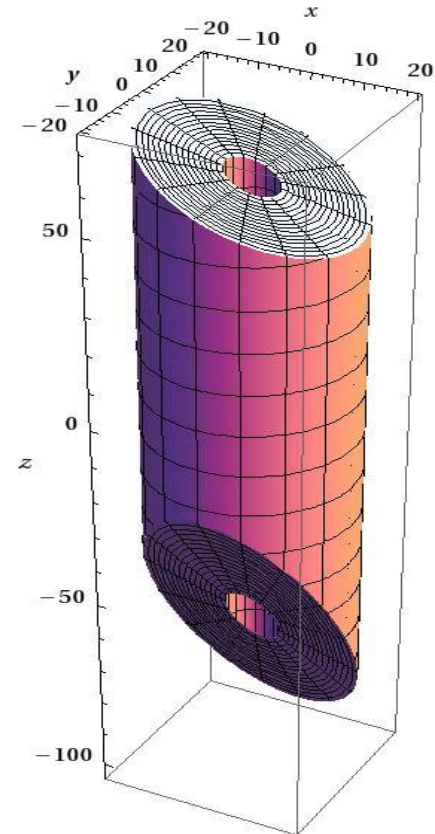 - **http://geant4.cern.ch/support/planned_features.shtml**

Geometry

- New solid "*G4CutTubs*", a tube segment cut with two planes in +- Z (ATLAS request)
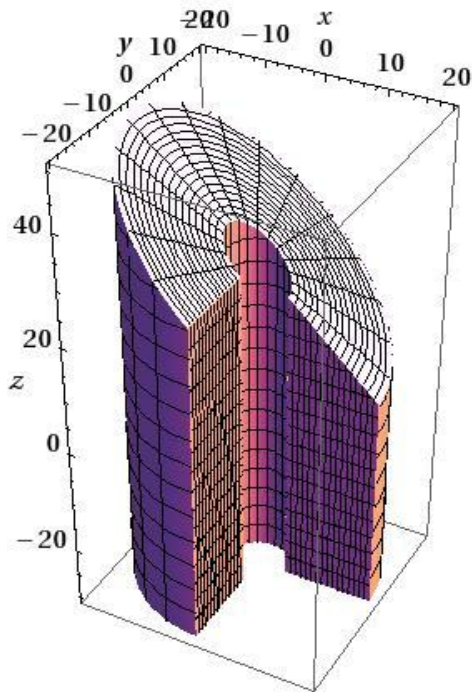
G4CutTubs(name, 5, 20, 30, 0 ,1.5Pi,
      G4ThreeVector(0, 0,   -1),
      G4ThreeVector(0.7, 0,0.71))
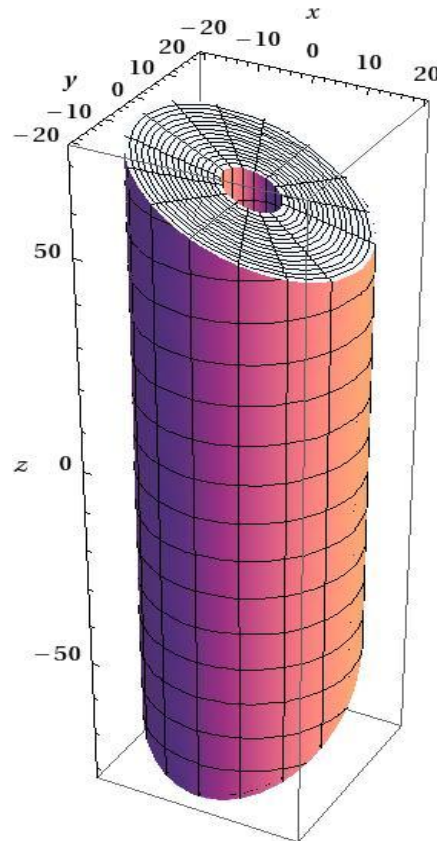
G4CutTubs(name, 5, 20, 60, 0 ,2Pi,
      G4ThreeVector(0,   0.7, -0.71),
   G4ThreeVector(0.5,   0, 0.87))

G4CutTubs(name, 5, 20, 60, 0 ,2Pi,
      G4ThreeVector(0,   -0.9, -0.44),
      G4ThreeVector(0.5,   0, 0.87))

# Parallel layered mass geometry

- Requirement officially advanced during the last Geant4 Workshop at ESTEC in 2010

- Extension of the existing parallel navigation feature

  - A step is limited on the boundary of any volume of any world

  - The step (and all physics processes) sees the material defined in the top-most later. If the top-most layer has null pointer to material, material in next layer is used
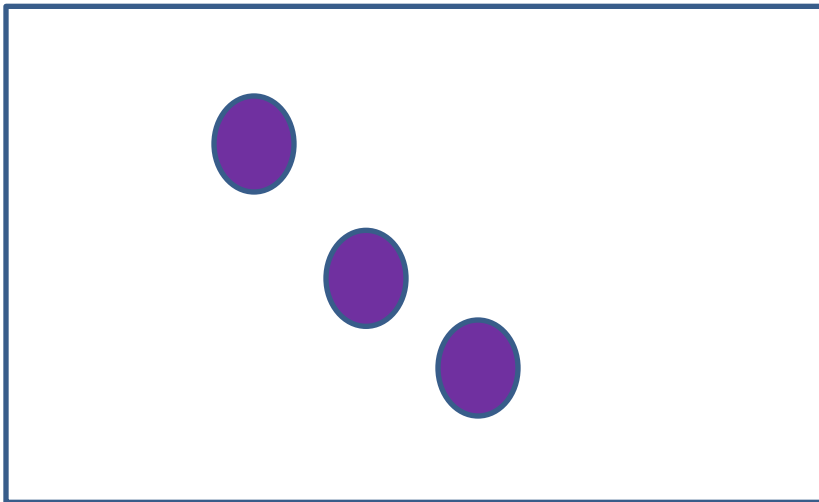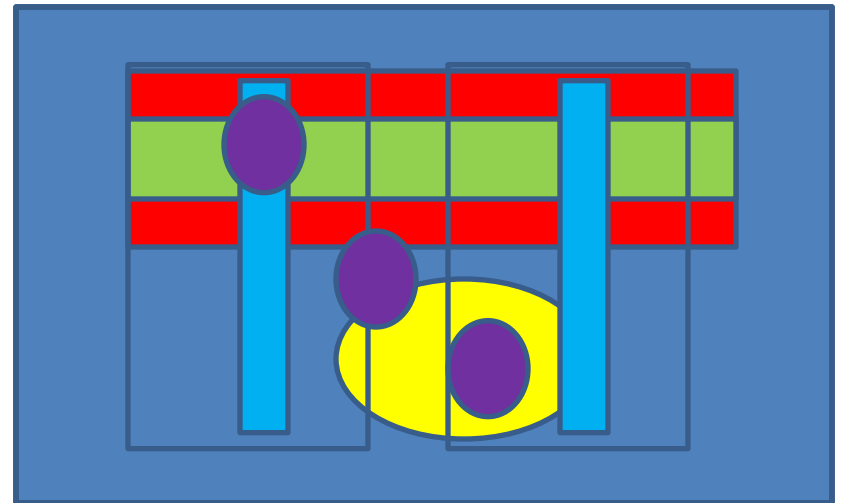
Parallel layered mass geometry - 2
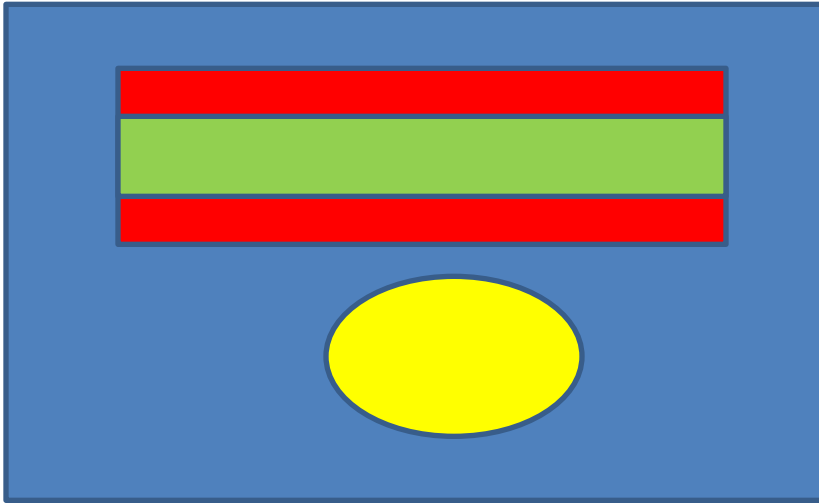
Mass world
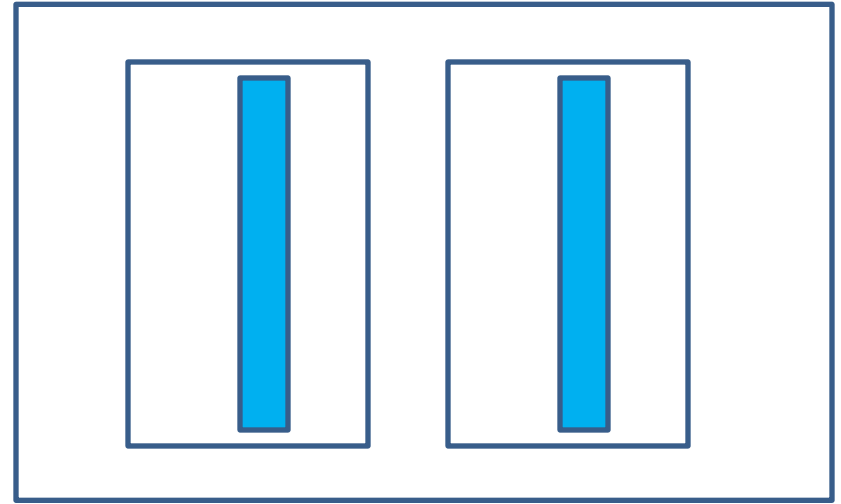
Parallel world - 1

Parallel world - 2

Tracking time

Geometry - fixes

- Fixes/tuning to field locators and navigation to further reduce cases of stuck particles on boundaries (ATLAS)

- Introduced protection in G4SubtractionSolid::DistanceToIn(p,v) to avoid potential cases of infinite loops

- Fixes to G4TriangularFacet::Intersect() and in G4TessellatedSolid
  - To take into account geometrical tolerance and cases of zero distance from surface's facet. Problem report #1242, affecting also G4ExtrudedSolid.

- Fix in G4TessellatedSolid::CreatePolyhedron()
  - To allow for proper visualization of Boolean compositions
  - Problem report #1235

- Fix to G4Paraboloid in DistanceToIn(p,v) and DistanceToIn(p)
  - To properly take into account tolerance and provide better estimation of distance. Problem report #1234

Enriched Event Biasing options

- Reviewed and unified existing biasing options
- New statistics tool for monitoring the conversion of the simulation results
- New options: i.e. introduction of "forced interaction"
  - Interaction is forced in a particular volume
  - Exploring physics tails regarding PID
    - Forcing K^0 to interact in vertex detector
    - Forcing kink to happen in tracking chamber
    - Forcing hadronic interaction for EM particle
  - Thin target experiment / beam test
  - Neutrino beam

Physics Lists

- Removal of ordering numbers in physics list
  - Improvement in usability
  - No longer necessary to manually set the order for EM processes
  - Automatic consistency check
    - Full compatibility with current user's physics lists
  - Easiness of combining physics builders
  - Easiness of adding a process to "pre-packaged" physics list
- New physics lists factory for combining all EM options
- Updated physics lists combinations and options

Warnings & Exceptions

- Unified format for warning/error messages
  - Addressing requirement from LHCb (seconded by other LHC experiments)
  - Enables automated detection of warning/error messages embedded in output files of massive production runs
  - All the warning/error messages have the same banner and footer.

- "cout"/"cerr" destinations are user-configurable

Materials

- Introduction of *variable density* materials
  - Allowing to define a base reference material
    - Density of each volume is used to scale the cross-sections at tracking time
  - Reduction of number of materials and corresponding cross-section tables
    - Example for air shower: a user may define one "air" of standard density, and density is defined in the parameterized volumes as "atmosphere layers"

Performance & Q/A

- Addressing to performance bottlenecks identified by the internal architecture review and benchmarks
  - Implementation of new scheme for the costly `GetVelocity()` method in `G4Track`
  - Adoption of new `G4PhysicsVector` class to cross-sections and other tables in physics processes/models
    - Reduced overall memory churn
- Addressing Coverity defects

More features …

- Extension to GDML schema (3.0.1) for material attributes
- New visualization driver "OGLFile"
  - using OpenGL to make PS, EPS, JPG without graphics window
  - ideal for batch jobs
- Improvements to Qt visualization driver and rendering speed
- Reorganization of novice and extended examples
  - New simple novice examples with clear guidance to extended examples for the way of extending each individual functionality
  - Work on extended examples continues in 2012
  - Anticipating steeper self-learning curve for new users and for experienced users on new features

9.5: more …

- ## Configuration
  - Complete installation system based on Cmake
  - Dropping old `Configure` script
- ## Particles
  - Updated properties of particles to PDG 2011

- First prototype of thread-safe/multi-core kernel
  - Alternative code tree Geant4-MT released based on release 9.4 series
  - http://geant4.cern.ch/support/download_MT_proto.shtml

- Complete list of planned developments for 2011 at:
  - http://geant4.cern.ch/support/planned_features.shtml

Planned supported platforms for 9.5

- Linux SLC5, gcc-4.1.2, gcc-4.3.X, 32/64 bits

- MacOSX 10.6, 10.7, gcc-4.2.1, 64 bits

- Windows/XP and CygWin Tools
  - Compiler Visual C++ 10.0 (Visual Studio 2010)

- Also tested: gcc-4.6.X, icc-11.X, VC++-9.0

Thanks!